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(54) **Title:** CALENDERED FABRICS FOR ULTRAVIOLET LIGHT PROTECTION

(57) **Abstract:** The invetnion provides a garment comprising at least a region consisting of a single thickness of a fabric comprising synthetic polymer filaments, wherein the fabric has been calendered on at least one surface thereof and the fabric has an ultraviolet protection factor as determined according to AATCC Test Method 183-1999 of at least 30. The invention also provides a layered fabric comprising a layer of the above fabric to provide UV protection and a layer of a second fabric or film such as a material that is sensitive to ultraviolet radiation. The invention also provides a process to prepare an ultraviolet light protective fabric comprising the steps of: forming a fabric from one or more multifilament yarns and calendering the fabric; followed by measuring the Ultraviolet Protection Factor (UPF) of the calendered fabric by AATCC Test Method 183-1998.

CALENDERED FABRICS FOR ULTRAVIOLET LIGHT PROTECTION

The present invention relates to a process for improving the ultraviolet (UV) ray blocking performance of fabrics, and to garments and other articles comprising improved fabrics produced by this process.

Public awareness of the dangers of excessive exposure to solar UV radiation has resulted in a need for textile fabrics that have a high solar UV protection factor (UPF, as hereinafter defined). The high UPF should preferably be achieved at low cost, without loss of comfort, durability, aesthetic qualities or other qualities of the textile fabric.

In apparel applications, a UPF below 15 is deemed “low protection”, a UPF of 15 to 30 is deemed “medium protection”, and a UPF greater than 30 is deemed “high protection”. The Australian Radiation Laboratory issues a special certification for fabrics that have a UPF of 40 or greater.

Fabrics having high UPF values are also needed to protect inanimate objects from solar and other UV radiation. In particular, such fabrics can form an outer layer to protect certain UV-sensitive fabrics and films having useful properties.

US patent number 6,037,280 (Edwards et al.), assigned to Koala Konnection, discloses an ultraviolet (UV) ray blocking textile which includes a fabric , UV blocking particles and a binding agent for attachment of the particles to the fabric. This document teaches the benefits of UV blocking textiles but only enables UV blocking by the process step of coating a fabric with certain UV blockers in combination with a binder. An ultraviolet protection factor is determined for certain combinations of fabric and particle. These combinations show a UPF improvement of from 2 to more than 3 times versus the fabric combination controls.

US patent number 5,503,917 describes woven fabrics having enhanced UV protection factors. The enhancement is achieved by the process steps of sanding the fabric, followed by air jet laundering.

The present inventors have found, surprisingly, that the UPF of a fabric comprising a portion of synthetic polymer filaments is greatly increased when the fabric is processed by calendering ("chintzing"). Calendering is a known technique for improving the wind resistance of certain fabrics, for reducing the leakage of fibers through a fabric from a fibrous insulation layer, or for changing the appearance of certain fabrics. However, calendering has not hitherto been applied for the improvement of UV protection factors.

It is an object of the present invention to provide garments exhibiting high ultraviolet protection factors.

It is a further object of the present invention to provide laminated structures in which a protective layer of a fabric having a high UPF is laminated to a layer of a second film or fabric.

In a first aspect, the present invention provides a garment comprising at least a region consisting of a single thickness of a fabric, wherein the fabric comprises synthetic polymer filaments, the fabric has been calendered on at least one surface thereof, and the fabric has an ultraviolet protection factor (UPF) as hereinafter defined of at least 30.

Preferably, the garment is selected from the group consisting of a shirt, blouse, trousers (long or short), a swimming costume or a hat. Preferably, the garment is an item of children's clothing. Preferably, the garment consists substantially or essentially of a single thickness of the fabric, for example a single thickness shirt. Such a garment can provide satisfactory protection against solar UV radiation when worn without any other garments, fabrics or sun protection covering the same region of the human body. In certain embodiments the fabric is calendered

on only one side, and this side may be the side of the garment that is worn next to the body.

The term "single thickness" refers to a single woven, nonwoven or knitted layer of the textile filaments. Preferably, the fabric has a weight of less than 150 g/m^2, more preferably 50 to 100 g/m^2. These are relatively light weight fabrics suitable for hot climates. Preferably, the fabric has an air permeability as hereinafter determined of at least 0.085 standard cubic meters (3 standard cubic feet) per minute at a static pressure of 125 Pa, more preferably at least 0.14 standard cubic meters (5 standard cubic feet) per minute. The relatively high air permeability *provides breathability and coolness to the fabric.*

The fabric comprises synthetic filaments, and preferably it consists essentially of synthetic filaments. Preferably, the synthetic filaments are thermoplastic, more preferably they are melt spun filaments, and most preferably they are selected from the group consisting of polyamide filaments, polyester filaments and mixtures thereof. Preferred polyamides are nylon 6, nylon 66, nylon 46, nylon 7, nylon 10, nylon 11, nylon 610, nylon 612, nylon 12 and mixtures and copolyamides thereof; preferred polyesters include polyethylene terephthalate (PET), polytrimethylene terephthalate (PTT) and polytetrabutylene terephthalate. The more preferred polyamides include nylon 6, nylon 66, and the more preferred polyesters include PET and PTT.

Preferably, the synthetic filaments comprise a UV absorbent material, and more preferably they comprise titanium dioxide particles. Preferred TiO_2 particles are of a size to function also as a delusterant (preferably 0.3 to 1 micrometer) and preferably they are present at a weight concentration of from 0.1 to 4 wt.%, more preferably from 0.5 to 3 wt.%. Alternatively or additionally, the polymers may include other additives for ultraviolet light absorption, such as: CYASORB (Registered Trade Mark) UV-3346, -1164,- 3638, -5411; and TINUVIN (Registered Trade Mark) 234 in amounts of about 0.1 to 0.3 per cent by weight.

The fabric in the garments according to the invention is calendered on at least one side. Calendering (chintzing) of fabrics is performed by applying heat and pressure to at least one surface of the fabric. Calendered surfaces are readily identified by the characteristic plastic deformation of the surface. The calendering temperature is preferably maintained in a range from 140°C to 195°C. The calendering pressure is preferably 50 tonnes/sq.inch (6.5 x 10^6 N/m^2) (+/- 10%) and the calendering is preferably performed at a speed in a range from 12 to 18 meters per minute.

Calendering is preferably carried out using a two roll nip. The first roll of the nip is has a hard, smooth heated surface such as heated stainless steel. The second roll is unheated and typically covered with nylon/wool or optionally paper covered. Calendering equipment of this type is available from Küsters Textile Machinery Corporation, I - 85, Zima Park Drive, P.O. Box 6128, Spartanburg, S.C. 29304, USA.

As will be illustrated in more detail by the examples below, the present inventors have found a very large and surprising enhancement in UPF values as a direct result of calendering. UPF has been enhanced by a factor of ten or more by calendering, and the calendered fabrics may exhibit a UPF of 500 or more, or even 1000 or more.

The fabric in the garments according to the present invention has an ultraviolet protection factor (UPF) as defined by AATCC Test Method 183-1999 of at least 30, more preferably at least 40, still more preferably at least 100 and most preferably at least 500. The present inventors have found that such UPF values are readily achievable by means of calendering.

In a second aspect, the present invention provides a multilayer fabric having an ultraviolet protection factor as defined by AATCC Test Method 183-1999 of at least 30 comprising: a first layer of a first fabric comprising synthetic polymer filaments, wherein the first fabric has been calendered on at least one surface thereof; and a

layer of a second fabric or a film, wherein the second fabric or the film is laminated to the first fabric.

The second fabric or the film may be a fabric or film that exhibits a low UPF in the absence of the calendered layer, for example the second fabric or film alone may exhibit a UPF less than 20 or less than 10, so that the first fabric is required to ensure that the laminate has a sufficiently high UPF to provide effective solar UV protection. Preferably, the laminate itself has a UPF of at least 80, more preferably at least 150.

Preferably, the laminate has a fabric weight of from 50 to 250 g/m^2, more preferably from 50 to 150 g/m^2.

In other preferred embodiments the second fabric or the film comprises a material that is sensitive to ultraviolet radiation. Such materials exhibit discoloration or unacceptable mechanical properties after exposure to direct sea-level solar UV for periods of 500 hours or more, more typically 100 hours or more. Examples of such UV-sensitive fabrics include certain polyesters and polyester derivatives such as copolyether ester copolymers. Other such materials include certain polyurethanes, polyvinyl chlorides and PTFE derivatives. The materials may also include UV-sensitive dyes or plasticisers. The surprisingly high UPF of the calendered first fabrics enables them to provide effective protection against UV degradation of the underlying UV-sensitive layer.

The preferred characteristics of the first fabric in this aspect of the invention are as specified above for the garment fabric of each of the preferred embodiments according to the first aspect of the invention. However, it is envisaged that the first fabric layer in these embodiments could be especially light weight, for example 50 g/m^2 or less.

The first fabric is preferably bonded to the second fabric by melt bonding, hydraulic entanglement, adhesive bonding, needling or other conventional methods.

In a third aspect, the present invention also provides a process to prepare an ultraviolet light protective fabric comprising the steps of: forming a fabric from one or more multifilament yarns; and calendering the fabric; followed by measuring the Ultraviolet Protection Factor (UPF) of the calendered fabric by AATCC Test Method 183-1998.

Preferably, the process according to the invention further comprises the step of measuring the UPF of the fabric before the step of calendering. This enables the effect of calendering on the UPF to be assessed and optimized.

Preferably, the calendering conditions are selected to increase the UPF by a factor of at least 1.5 in the step of calendering, more preferably by a factor of at least 3, and most preferably by a factor of 10 or more. In certain preferred embodiments the UPF before calendering is below 40 and the UPF after calendering is greater than 40. In other preferred embodiments, the UPF before calendering is greater than 30, more preferably greater than 50, and the UPF after calendering is more than 3 times, more preferably more than 10 times the UPF before calendering.

Preferably, the fabric before the step of calendering has a UPF below a predetermined threshold value, and wherein the calendering conditions are selected so as to increase the UPF of the calendered fabric to a value greater than the predetermined threshold value. Preferred threshhold values include UPF values of 30, 40, 100 and 1000, depending on the intended use of the fabric.

The preferred characteristics of the calendered fabrics according to this aspect of the invention are as specified above for the garment fabric of each of the preferred embodiments according to the first aspect of the invention. Preferred calendering methods and conditions for use in this aspect of the invention are described above.

In a fourth aspect, the present invention further provides a method of manufacture of a layered material comprising the steps of: preparing an ultraviolet light

protective fabric by a process according to the invention, followed by laminating the ultraviolet light protective fabric to a second fabric or film. Preferably, the characteristics of the layered material and of the second fabric or film are as hereinbefore described in relation to the second aspect of the present invention.

In a fifth aspect, the present invention provides a method of manufacture of a garment comprising the steps of: preparing an ultraviolet light protective fabric by a process according to the invention, followed by making the fabric up into the garment wherein at least a region of the garment consists of a single thickness of the fabric. Preferably, the characteristics of the garment are as hereinbefore described in relation to the first aspect of the invention.

Specific embodiments and procedures of the present invention will now be described further, by way of example, as follows.

Measurement of Fabric UPF values

Fabric UPF values are determined according to AATCC Test Method 183-1999 entitled Transmittance or Blocking of Erythemally Weighted Ultraviolet Radiation Through Fabrics (a complete method may be ordered online at: www.aatcc.org/testmthds). This standard test method determines the ultraviolet radiation blocked or transmitted by textile fabrics over a range of UV wavelengths, with appropriate weighting to allow for both the solar UV spectrum energy distribution and the relative amounts of skin damage caused by different UV wavelengths (the erythemal weighting).

Briefly, the transmission of ultraviolet radiation through a specimen is measured on a spectrophotometer or spectroradiometer at known wavelength intervals. An ultraviolet protection factor (UPF) is computed as the ratio of a weighted UV radiation irradiance at the detector with no specimen to a weighted UV irradiance at the detector with a specimen present. The weighting factor is chosen to reflect the potential damage to the skin (erythema) caused by UV radiation in that wavelength interval, and is described in the test method. The weighted UV

irradiance at the detector in the absence of a test specimen is equal to the summation between wavelength intervals of the measured spectral irradiance, multiplied by the relevant erythemal weighting for that wavelength interval, multiplied by the weighting function of the appropriate solar radiation spectrum, multiplied by the wavelength interval. The weighted UV- irradiance at the detector with a specimen present is equal to the summation between wavelength intervals of the measured spectral irradiance for the specimen multiplied by the wavelength interval. This method also enables the percentage blocking of UVA and UVB radiation to be calculated.

Measurement of Fabric Air Permeability

Fabric air permeability is measured in units of standard cubic feet per minute (SCFM) by the test method BS EN ISO 9237 at a static pressure of 125Pa. 1 SCFM equals 0.028 standard cubic meters per minute.

Example 1 (Comparative)

The effects of additives on the measured UPF of uncalendered woven fabrics were studied for comparison purposes.

Briefly, fabrics were woven with warp and weft yarns as specified in Table 1. In each case, the test yarn was used as the weft yarn, which was woven across a standard warp. The fabrics were scoured and dried, but were not otherwise processed. Fabric sample W7775 was dyed light green, but none of the other samples was dyed. The fabrics were not calendered. The measured UPF and air permeability values are reported in Table 1.

It can be seen that the fully bright (substantially TiO_2 free) fabrics O, W7775 and W7306 have UPF values in the range of only 3.9 to 5. This is too low for effective protection against solar UV. Interestingly, the addition of a light green dye in W7775, or of an optical brightener in W7306, had relatively little effect on the UPF.

The dull (1.0 and 1.5% TiO_2 in the weft yarn only) fabrics P and Q have UPF values of 7.3 and 7.8. This is still too low for effective protection against solar UV.

The dull (1.5% TiO_2 in the warp yarn only) fabric O2 has a UPF of 36.55. This UPF provides a higher degree of protection against solar UV, but is largely due to the high TiO_2 content of the fabric resulting from the higher yarn weight, filament count and weaving density of the warp yarn.

The fully dull fabric (1.5% TiO_2 in the warp and the weft) sample Q2 has a UPF value of 84.4. This illustrates the UV absorbing effect of TiO_2.

However, it can be seen that the highest UPF values achieved by the uncalendered fabrics is less than 100. Higher UPF values may be desirable for certain applications. Moreover, it desirable for certain applications to reduce the amount of UV-absorbing material such as TiO_2 in the fabric, since the presence of high loadings of delustrant changes the appearance of the garment completely.

Example 2 (comparative)

The effects of varying the filament count of the yarns and the weaving density on measured UPF of a number of uncalendered fabrics were studied for comparison purposes. The results are reported in Table 2.

It can be seen that increasing the filament count of the yarns and increasing the weaving density each tends to increase the UPF values, as would be expected. However, both effects are relatively small, and much less than the effect of adding TiO_2 to the filaments, or the effect of calendering. It will also be appreciated that heavy weight fabrics and tightly woven fabrics are less likely to be acceptable in hot climates where protection against solar UV is most needed.

Example 3

The effect of calendering on the measured UPF values of certain fabrics was studied as follows. The results are reported in Table 3.

The calendering process was carried out using a two roll nip from Küsters Textile Machinery Corporation, I - 85, Zima Park Drive, P.O. Box 6128, Spartanburg, S.C. 29304, USA. The first roll of the nip was heated stainless steel and the second roll was unheated and covered with nylon/wool. The calendering temperature was about 165°C. The calendering pressure was about 50 tonnes/sq.inch (6.5×10^6 N/m^2) (+/- 10%) and the calendering was performed at a speed of about 16 metres per minute.

The last six results reported in Table 3 were for pairs of fabrics. Each pair of fabrics was identical except for the calendering process. The comparison of items W6948 with W6956 shows that the UPF improved by a factor of 12. The comparison of items W6946 with W6938 shows the UPF improved by a factor of 24. The comparison of the fabrics K11478 before and after calendering shows that this effect extends also to the calendering of knitted fabrics.

The fabric pairs conclusively showed that calendering improves UPF very significantly, and that this effect is seen for both woven and knitted fabrics. The unpaired example W7494 illustrates the exceptionally high UPF values that can be achieved by calendering even quite light-weight fabrics.

The above examples have been described for the purpose of illustration only. Many other embodiments falling within the scope of the accompanying claims will be apparent to the skilled reader.

TABLE 1

Sample	Warp Yarn	Weft Yarn	Weave	Air Permeability (cubic ft./min	UPF
O	90f102 Nylon 66 Bright	78f20 Nylon 66 Bright	Ends:57.5/cm Picks:30.6/cm Fabric Weight: -----	17.3	3.9
P	90f102 Nylon 66 Bright	78f20 Nylon 66 Dull (1% TiO2)	Ends:56/cm Picks:30/cm Fabric Weight:------	13.8	7.8
Q	90f102 Nylon 66 Bright	78f20 Nylon 66 Dull (1.5% TiO2)	Ends:58/cm Picks:30/cm Fabric Weight:-----	16.1	7.3
O2	90f102 Nylon 66 Dull (1.5% TiO2)	78f20 Nylon 66 Bright	Ends:55/cm Picks:35/cm Fabric Weight: 87.2g/m^2	11.3	36.55
Q2	90f102 Nylon 66 Dull (1.5% TiO2)	78f20 Nylon 66 Dull (1.5% TiO2)	Ends:55/cm Picks:35/cm Fabric Weight: 88.4g/m^2	10.7	84.4
W7775	50f15 Bright Nylon with Light Green Dye	50f15 Bright Nylon with Light Green Dye	Ends:62.5/cm Picks:45/cm Fabric Weight: 97.3 g/m^2	-	5
W7306	50f15 Bright Nylon with Optical Brightener	50f15 Bright Nylon with Optical Brightener	Ends:61/cm Picks:47/cm Fabric Weight: 62 g/m^2	-	4.6

All fabrics are uncalendered

TABLE 2

Sample	Warp Yarn	Weft Yarn	Weave	Air Permeability (cubic ft./min	UPF
Q2	90f102 Nylon 66 Dull (1.5% TiO2)	78f20 Nylon 66 Dull (1.5% TiO2)	Ends: 55/cm Picks: 35/cm Fabric Weight: 88.4g/m^2	10.7	84.4
T6342	90f102 Nylon 66 Dull (1.5% TiO2)	78f51 Nylon 66 Dull (1% TiO2)	Ends: 55/cm Picks 35/cm/ Fabric Weight: 87.5g/m^2	6.83	109
PET	90f102 Nylon 66 Dull (1.5% TiO2)	78f68 PET Dull (1.5% TiO2)	Ends: 55/cm Picks: 35/cm Fabric Weight: 94g/m^2	4.91	138
C1	90f102 Nylon 66 Bright	78f51 Nylon 66 Dull (1% TiO2)	Ends: 48/cm Picks: 32/cm Fabric Weight: 78.8g/m^2	18.4	10.1
C2	90f102 Nylon 66 Bright	78f51 Nylon 66 Dull (1% TiO2)	Ends: 48/cm Picks: 35/cm Fabric Weight: 84g/m^2	10.9	14.2
C3	90f102 Nylon 66 Bright	78f51 Nylon 66 Dull (1% TiO2)	Ends: 48/cm Picks: 37/cm Fabric Weight: 83.6g/m^2	13.0	14.5
C4	90f102 Nylon 66 Bright	78f51 Nylon 66 Dull (1% TiO2)	Ends: 48/cm Picks: 38/cm Fabric Weight: 86.9g/m^2	10.2	15.9

All fabrics are uncalendered.

TABLE 3

Sample	Warp Yarn	Weft Yarn	Weave/Knit	UPF
W7494 Calendered	78f51 full-dull Nylon (1.5%Tio2))	78f51 full-dull Nylon	Ends: 55/cm Picks: 49/cm Fabric Weight: 84.4g/m^2	7724
W6948 Calendered	78f51 full-dull Nylon	100f51 full-Dull AJT Nylon	Ends: 60/cm Picks: 35/cm Fabric Weight: 90g/m^2	1654
W6956 Uncalendered	78f51 full-dull Nylon	100f51 full-Dull AJT Nylon	Ends: 61/cm Picks: 35/cm Fabric Weight: 92g/m^2	135
W6946 Calendered	78f51 full-dull Nylon	135f114 full-dull AJT Nylon	Ends: 60/cm Picks: 31/cm Fabric Weight: 98g/m^2	5582
W6938 Uncalendered	78f51 full-dull AJT Nylon	135f114 full-Dull AJT Nylon	Ends: 60 Picks: 31 Fabric Weight: 100g/m^2	234
K11478 Calendered	110f92 Nylon 66 Dull (1.5% TiO2) with Spandex		28 Gauge Single Jersey Knit	9241
K11478 Uncalendered	110f92 Nylon 66 Dull (1.5% TiO2) with Spandex		28 Gauge Single Jersey Knit	459

CLAIMS

1. A garment comprising at least a region consisting of a single thickness of a fabric comprising synthetic polymer filaments, wherein the fabric has been calendered on at least one surface thereof and the fabric has an ultraviolet protection factor as determined according to AATCC Test Method 183-1999 of at least 30.

2. A garment according to claim 1, wherein the garment is selected from the group consisting of a shirt, trousers (long or short), a swimming costume or a hat.

3. A garment according to claim 1 or 2, wherein the garment consists substantially or essentially of a single thickness of the fabric.

4. A garment according to any preceding claim, wherein the fabric has a weight of less than 150 g/m^2, preferably 50 to 100 g/m^2.

5. A garment according to any preceding claim, wherein the fabric has an air permeability as determined by the test method BS EN ISO 9237 at a static pressure of 125 Pa of at least 0.085 standard cubic meters (3 standard cubic feet) per minute, preferably at least 0.14 standard cubic meters (5 standard cubic feet) per minute.

6. A garment according to any preceding claim, wherein the fabric comprises synthetic filaments selected from the group consisting of polyamide filaments, polyester filaments and mixtures thereof.

7. A garment according to claim 6, wherein the synthetic filaments are selected from nylon 6, nylon 66, nylon 46, nylon 7, nylon 10, nylon 11, nylon 610, nylon 612, nylon 12 and mixtures and copolyamides thereof.

8. A garment according to claim 6, wherein the synthetic filaments are selected from the group consisting of polyethylene terephthalate (PET), polytrimethylene terephthalate (PTT) and polytetrabutylene terephthalate.

9. A garment according to any preceding claim, wherein at least a portion of the synthetic filaments comprise a UV absorbent additive in addition to the synthetic polymer.

10. A garment according to claim 9, wherein the UV absorbent additive comprises titanium dioxide particles at a weight concentration of from 0.1 to 4 wt.%, preferably from 1 to 3 wt.%.

11. A garment according to any preceding claim, wherein the fabric is calendered on only one side.

12. A garment according to any preceding claim, wherein the fabric has a UPF of at least 40.

13. A garment according to any preceding claim, wherein the fabric has a UPF of at least 100.

14. A garment according to any preceding claim, wherein the fabric has a UPF of at least 500.

15. A garment according to any preceding claim, wherein the fabric has a UPF of at least 1000.

16. A garment according to any preceding claim, wherein the fabric has not been dyed.

17. A multilayer fabric having an ultraviolet protection factor as determined according to AATCC Test Method 183-1999 of at least 30, said multilayer fabric comprising: a first layer of a first fabric comprising synthetic polymer filaments,

wherein the first fabric has been calendered on at least one surface thereof; and a layer of a second fabric or a film, wherein the second fabric or the film is laminated to the first fabric.

18. A multilayer fabric according to claim 17, wherein the second fabric or the film taken alone has a UPF of less than 10

19. A multilayer fabric according to claim 17 or 18, wherein the second fabric or the film comprises a material that is sensitive to ultraviolet radiation.

20. A multilayer fabric according to claim 19, wherein the material that is sensitive to ultraviolet radiation comprises a polyester or a polyester derivative.

21. A multilayer fabric according to any one of claims 17 to 20, wherein the first fabric is bonded to the second fabric by a method selected from melt bonding, hydraulic entanglement, adhesive bonding, needling or a combination thereof.

22. A process to prepare an ultraviolet light protective fabric comprising the steps of:

forming a fabric from one or more multifilament yarns; and

calendering the fabric; followed by

measuring the Ultraviolet Protection Factor (UPF) of the calendered fabric by AATCC Test Method 183-1998.

23. A process according to claim 22, further comprising the step of measuring the UPF of the fabric before the step of calendering.

24. A process according to claim 23, wherein the calendering conditions are selected to increase the UPF by a factor of at least 1.5 in said step of calendering.

25. A process according to claim 22, 23 or 24, wherein the fabric before the step of calendering has a UPF below a predetermined threshold value, and

wherein the calendering conditions are selected so as to increase the UPF of the calendered fabric to a value greater than the predetermined threshold value.

26. A method of manufacture of a multilayer fabric comprising the steps of:

preparing an ultraviolet light protective fabric by a process according to any one of claims 22 to 25, followed by

laminating the ultraviolet light protective fabric to a second fabric or film.

27. A method according to claim 26, which is adapted to manufacture a multilayer fabric according to any one of claims 17 to 21

28. A method of manufacture of a garment comprising the steps of:

preparing an ultraviolet light protective fabric by a process according to any one of claims 22 to 25, followed by

making the fabric up into the garment wherein at least a region of the garment consists of a single thickness of the fabric.

29. A method according to claim 28, wherein the garment is a garment according to any one of claims 1 to 16.

INTERNATIONAL SEARCH REPORT	ational Application No PCT/GB 02/00317

A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 98 03708 A (BOEHRINGER BERTRAM KURT ;SCHINDLING GERHARD OTTO (DE); AKZO NOBEL) 29 January 1998 (1998-01-29) page 4 -page 5; example 3	1-4, 6-10,12, 13,17, 18,21, 26-29
A	US 5 503 917 A (HUGHES SHAUN N G) 2 April 1996 (1996-04-02) cited in the application column 3, line 17 -column 4, line 44	1-3,12, 13,16,22
A	EP 0 345 820 A (KIMBERLY CLARK CO) 13 December 1989 (1989-12-13) claim 1	1-3,5,11

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
3 May 2002	14/05/2002
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer D'Souza, J

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